wriggles away sideways, and refuses to give any hold for jaws or palate. In fact, a more slippery or guileful egg was never yet devised by nature's unconscious ingenuity."

Eggs of *C. Philippi* wedged in the sheltered crevices as described could not be reached by Mr. Allen in the person of the predaceous fish, and for eggs of *C. galeatus*, closely entangled among seaweed, much dodging would be impossible. Moreover, so well are they concealed, that antics such as those described would be unnecessary.

EXPLANATION OF PLATE XII.

Figs. 1 & 2. Egg of *Cestracion Philippi*, Schneider, and section of same. ½ nat. size.

Fig. 3. Egg of *Cestracion galeatus*, Günther. ½ nat. size.

On the Structure of the Isopod Genus *Ourozeuktes*, Milne-Edwards.

By A. Vaughan Jennings, F.L.S., F.G.S., Demonstrator of Botany and Geology in the Royal College of Science, Dublin.

[Read 20th June, 1895.]

(Plates XIII. & XIV.)

As long ago as 1840 Professor Milne-Edwards * gave the name of *Ourozeuktes* to an Isopod Crustacean which he had received from the late Sir Richard Owen, without information as to its habit or the locality in which it was found. He recognized it as one of the family Cymothoidæ, and gave it this generic name in consideration of the fact that all the abdominal segments are fused together, leaving in the adult only faint lines indicating the original sutures. His definition of the generic characters is clear and accurate, and the accompanying figure is a satisfactory representation of a dried specimen viewed from the dorsal surface. It gives, however, a quite inadequate idea of the appearance of the animal before desiccation, and I believe I am right in saying that no satisfactory illustration has since been published of this remarkable form.

* 'Histoire N. des Crustacés, p. 275, pl. 33. fig. 8 (1840).

Prof. Milne-Edwards's figure reappears in Bronn's 'Klassen und Ordnungen des Thier-Reichs,'* which gives also a figure of the larval stage; and more recently Messrs. Schiödte and Meinert† have described two specimens which they regard as distinct species. These also seem to be drawn from dried specimens, and add nothing to our knowledge of the morphology of the genus.

A year or two ago, while I was engaged in arranging the new Museum at the Free Public Library in Whitechapel, the Rev. Dan. Greatorex (who generously gave his collection as the nucleus of that Museum) called my attention to a curious Crustacean of almost spherical shape which he had never been able to identify. This proved on investigation to be a fine specimen of *Ourozeuktes Owenii*, which, having been preserved in spirit immediately after capture, shows admirably the natural form of the organism. It was given to Mr. Greatorex by the captain of a sailing-ship, who said it had been taken at sea near Kerguelen Island, and there seems no reason to doubt that the locality is correct.

The specimen is nearly two inches in length and more than an inch in breadth across the widest tergum; whilst the enormously developed brood-chamber below, three quarters of an inch in depth, makes the animal appear almost globular when viewed from the front. As all the previously recorded specimens seem to have been females, it is probable that, like other Cymothoidæ, the animal is hermaphrodite and proterandrous‡. The brood-chamber contained a considerable number of larvæ about 3 millim. long, all in the same stage of development.

It is unfortunate that we have no further details as to the habit of the animal, but it is almost certainly parasitic, partly or entirely. This and other general questions will, however, be best left till some account has been given of its external anatomy, so far as may be learnt from the single specimen at disposal.

* 'Arthropoda,' Band v. Abth. 2, Taf. viii. fig. 20 (1881), and Taf. xxvi. fig. 1 (1883).

† Nat. Tidskrift, vol. xiv., Copenhagen, 1884.

‡ Bullar, "Generative Organs of Parasitic Isopoda," in the 'Journal of Anatomy and Physiology,' 1876, p. 118; and Mayer, "Ueber d. Hermaphroditismus einiger Isopoden," in Mittheil. Zool. Stat. Naples, 1879.

I. *The Cephalic Region.*

The *head* is small and subtriangular in shape, sunk in a deep notch between the lateral portions of the first thoracic segment, which extend far forward on each side so that their anterior borders are on a level with the eyes and almost reach the antennæ. The *eyes* are of moderate size, situated near the lateral margin of the head, and densely pigmented. They are, of course, compound, and the hexagonal lens-areas, as in other Cymothoidæ, are comparatively few in number and large in size.

Below the anterior border projects very slightly a membranous upper lip or *labrum*.

Appendages of the Cephalic Region.

(1) The *first antennæ* are about 5 mm. in length, subulate, pointed, and composed of seven joints. They arise below the margin of the head-shield and are directed outward transverse to the axis of the body.

(2) The *second antennæ* are in general similar but slightly longer and more slender, and composed of eight joints. Their origin is immediately behind that of the first pair, and the bases of both are crossed at right angles by the mandibular palp.

(3) The *mandibles* are of somewhat unusual form. They have a strong conical base attached to the sternal region of the segment some distance back, and rather far from the middle line. From the distal end of this basal portion a much slenderer calcified rod runs obliquely forward and inward, ending in a transverse oval structure with a minute chitinous tooth meeting its fellow of the opposite side. From the anterior outer angle of the basal portion rises the soft, pointed, 3-jointed *palp*, which is directed straight forward and, as already stated, crosses at right angles the bases of the antennæ (Pl. XIV. figs. 3 & 5).

Immediately behind the terminal plates of the mandibles comes the soft bi-lobed *labium*, and the two together give a cruciate appearance when the head is looked at from the front with all the mouth-parts in place. The undersides of the labial lobes are grooved for the reception of the succeeding pair of appendages.

(4) The *first maxillæ* are reduced to a pair of cylindrical, pointed, scarcely calcified styles which arise immediately to the

inner side of the mandibles and run forward parallel to these, to end in the grooves on the labium mentioned above.

(5) The *second maxillæ* are small oblong plates rising from a short basal joint just internal to the first maxillæ. Their inner margins are slightly curved, and they terminate in front in a straight transverse fringed border behind the labial lobes.

(6) The *maxillipedes* are considerably larger, and have a wide, well-calcified base articulating somewhat obliquely with the sternal area. The main lobe is quadrate in shape, and has a thickened anterior border lying just behind the fringed margin of the second maxillæ. There is a short palp-like two-jointed lobe lying along its inner margin.

These four pairs of appendages are again covered ventrally, as far forward as the labium, by the first pair of oostegites.

Taken as a whole the mouth-parts are not strongly developed; they are comparatively feeble and soft, with little chitinous or calcareous material, indicating a suctorial rather than a masticatory habit. The mouth-aperture itself is very small and far forward, and the various appendages converge toward it. The pointed tips of the mandibles would be just strong enough to attack soft tissues, and to keep open a passage through which fluid nutriment could be ingested by the sucking action of the labium and succeeding parts.

In the case of such Isopods as live on the gills of fish, food may be obtained by such a direct or true parasitism, but a set of jaws like those of *Ourozeuktes* would probably be capable of dealing also with small organisms if the animal were in a free stage or only holding on by its hooked limbs to the outside of a fish.

With regard to the grooves in the labium in which the maxillary rods terminate, Professor Howes has kindly called my attention to the fact that in the common Crayfish the endopodite of the second maxilla runs across the labium and fits into a depression in the mandibles *.

II. *The Thoracic Region and its Appendages.*

The thoracic region consists of the typical seven segments with wide terga and well-developed epimera. The latter carry the corresponding limb-sockets, and are also prolonged down

* *Cf.* Huxley and Martin's 'Elementary Biology,' ed. 1888, pp. 199, 200.

between these to form the calcified parts of the foliaceous oostegites.

While the first tergum is, as already stated, prolonged forward on each side of the head, the last has a similar tendency to the horseshoe form, its lateral areas spreading back round the base of the abdominal region. Of the remainder the second, third, and fourth are considerably longer antero-posteriorly than the fifth, sixth, and seventh.

The seven pairs of limbs are all constructed on the same plan. A large flattened basipodite (to which is fused a small round coxopodite fitting into the limb-socket) is followed by an ischiopodite, three approximately equal joints, and a curved claw.

The flattening of the basipodite increases from before backward, and in the last four pairs the ischiopodite also becomes increasingly lamellar, so that these hinder limbs are very efficient swimming-organs.

The remaining structures belonging to the thoracic region are the large foliaceous plates or *oostegites*, which together form the great brood-chamber below the body of the animal, in which the eggs and embryos pass through their successive developmental stages. It is of course well known that such a structure occurs in many genera of Isopods and, with little difference, of Amphipoda also; but I have not as yet met with any description of one so large or fully developed as that now under consideration.

There are four of these large oostegites or plates, as they may be called for the sake of brevity, on either side of the body passing round from the line of the limb-sockets toward the ventral middle line, where the series on the left side overlaps that of the right.

It is to be noted, however, that these plates have no connexion with the limbs themselves. The calcification which supports their basal and central parts is prolonged down from the epimera, usually from the thickening in front of the limb-socket; so that the free movement of the limbs in no way interferes with the rigidity of the walls of the chamber (Pl. XIV. fig. 11).

I mention this specially, as the usual descriptions in our text-books,—such as "brood-lamellæ attached to more or fewer of the thoracic limbs,"* or "thoracic legs . . . in the female some of them provided with delicate membranous plates (oostegites) which

* 'Forms of Animal Life,' Rolleston-Jackson, 1888, p. 537.

form a brood-pouch,"*—even if they apply to other Isopoda, are not applicable to this genus.

The second pair of oostegites rise from a calcification prolonged down from the anterior region of the thickening over the second limb-socket. They overlap in front the bases of the first pair, and are, in turn, overlapped by the *third oostegites*. These rise in a similar manner from a descending calcification in front of the third thoracic limb-socket, and they overlap the fourth pair of plates behind as well as the second in front.

The *fourth oostegites* are the largest pair, and seem to be connected with the sockets of both the fourth and fifth pairs of limbs: the calcareous supporting bar derived from both these sources takes a semicircular sweep backward toward the postero-dorsal angle.

The *fifth oostegites* rise from in front of the sixth pair of limbs. They overlap the fourth pair in front, and are prolonged backward as a pair of oblong plates covering the abdominal appendages for more than half the length of that region of the body, and by pressing on the large first abdominal appendages completely close the brood-chamber behind.

These four pairs of plates form by far the greater part of the wall of the brood-chamber; but between the anterior margins of the second pair and the sternal region of the head the space is filled in by the small first pair, which fit closely against the second oostegites behind and are appressed to the maxillipedes above, thus entirely closing the chamber in front, just as the fifth oostegites close it behind.

III. *The Abdominal Region and its Appendages.*

The third region of the body consists of six abdominal segments and a broad triangular caudal plate, the segments being fused together, as already stated and as implied by the generic name.

Viewed dorsally, this area still shows the lines of suture of the various segments, and the central part is distinctly marked off from the lateral, giving an appearance much like that of a trilobite pygidium. The caudal plate is thin and delicate in structure, marked by light and dark bands like those on the abdominal appendages—a similarity which suggests that it may serve (and the oostegites also) as an accessory respiratory organ.

* 'Text-book of Zoology,' Claus-Sedgwick, 1884, p. 457. Other cases might be added; and Milne Edwards, in the original description, refers to the limbs "*carrying at their bases* large foliaceous plates."

The underside of the abdomen I have not been able, in the single specimen in question, to examine in detail. It is, however, possible, by turning back the last pair of oostegites, to see the end of the thoracic sternites, here soft, with a little chitinous matter and a marked conical central papilla (Pl. XIV. fig. 9).

Behind this the thoraco-abdominal suture is evident, and the bases of the *first pair of abdominal appendages* are large and prominent.

The basal joint is bilobed, and bears the large curved plate which we have already noticed as overlapping the dorsal surface of the abdomen above and covering its ventral aspect. Its central region is more strongly calcified than the flexible membranous borders.

The inner angle of the basal segment bears also a true gill-plate lying over (ventral to) those of the succeeding four pairs of appendages, and resembling in form and structure the third lamella of appendages two to five.

The *typical abdominal appendage*, such as is found on segments two to five, has a short basal joint, moderately calcified and imperfectly subdivided, bearing three perfectly distinct lamellæ (Pl. XIV. fig. 10).

On the outside (ventral surface) is a delicate square plate attached to an outer calcification of the basal segment; it is very thin in texture, and the anastomosing blood-vessels are plainly visible.

The middle or largest lamella is triangular in outline, and attached to the main portion of the basal joint: a glance at the dorsal surface shows, however, that it is not attached along the whole of the base, but only at a middle point in a deep sinus, so that its basal margin is markedly cordate.

The third or smallest lamella is less than half the size of the last, of an oval shape, pointed at the distal end, and attached in the proximal region between two unequal forwardly extending lobes; so that it has the same cordate base as the middle lamella, but more irregular.

The third, fourth, and fifth abdominal appendages are all constructed on the type of the second, which I have chosen for description.

The sixth pair, which are so prominent in the larva, still retain the same structure—a basal joint with two flattened lamellæ. In the adult, however, the lamellæ are almost equal in size, narrow in proportion to their length, and devoid of setæ. The

whole appendage seems degenerate, and the tips only are visible between the tail-plate and the lamella of the first abdominal appendage, its function in swimming being apparently taken on by the thoracic limbs.

IV. *The Larval Stage.*

The larvæ found in the brood-chamber seem to be all in about the same stage of development, and all measure about 3 mm. in length.

They possess the subtriangular head of the adult, bearing two large eyes and two pairs of antennæ; but there is no sign of that antero-lateral growth of the first thoracic segment which is so distinctive of the full-grown animal.

The seven thoracic segments show little difference from one another; they bear six pairs of thoracic limbs, each of seven joints, and ending in a strong claw.

In the abdominal region the segments are also at this stage free; but the large caudal plate is already well developed. The last segment bears a pair of limbs, each composed of a basal joint and two oval lamellæ, the outer twice as long as the inner. These and the caudal plate bear strong marginal setæ, and the whole group, no doubt, forms a strong swimming mechanism.

The above statement covers, I believe, all I can say as to the anatomy of *Ourozeuktes*; but as the genus is so little known, it may be useful, for those who will some day have more material to study, to summarize the previous records.

At the commencement I have referred to the establishment of the genus by Milne-Edwards and of its recognition by Gerstaecker. Professor Haswell * mentions a specimen, which he calls provisionally *O. pyriformis*, in the Sydney Museum, and I take this to be the one collected by the 'Novara' Expedition †.

Messrs. Schiödte and Meinert ‡ add two species—the one *O. Monacanthi*, said to be from the "body-cavity" of a *Monacanthus* (one of the Balistidæ) preserved in the Museum at Vienna; the other, *O. caudatus*, a badly preserved specimen taken by Schomburgk near Adelaide, and now in the Berlin Museum.

* Haswell, 'Catalogue of Australian Crustacea.' Sydney, 1888.

† Heller, Reise der 'Novara,' Crustacea, p. 148.

‡ Nat. Tidskrift, vol. xiv. Copenhagen, 1884.

They also refer to one in the "Museo Godeffroyana" at Hamburg, said to be from Meridional America; but the locality is here doubtful.

To this list I can only add that there are two dried specimens in the British Museum, which show no special characters, and should doubtless be included in the original species. I have been able to examine them through the kindness of Professor Jeffrey Bell.

In this paper I have no intention of discussing the question of species, as I have no pretence to be a student of this particular group. I may say perhaps that Messrs. Schiödte and Meinert's two species differ from the original in little beside their smaller size, which in a Crustacean is not very reliable ground for specific distinction. Also in these cases, as in that of the Sydney Museum, the narrowness of the abdominal region seems, at first sight, a point of importance; but when one considers the greater delicacy of all the posterior portions compared with the strong thoracic rings, one can understand how easily such an appearance may be produced in drying. My own opinion is that the original example was very well preserved as a dried specimen, and that the others only differ in the shrunk condition of their tissues.

The question of species, however, is of less importance than that of the habit of this animal; but unfortunately I have here no further evidence to give.

Probably the nearest living relative of *Ourozeuktes* is the remarkable genus *Ichthyoxenos* described by Herklots *, and more recently (in a paper to which Prof. Howes has kindly called my attention) by Professor Max Weber †. This genus lives entirely in special cavities in the integument of a fish (*Puntius maculatus*, Bleeker) in the rivers of Java. It is less specialized than *Ourozeuktes* in having the abdominal segments free and the first abdominal appendage scarcely modified. Moreover, it has not the thoracic limbs flattened; and this I take as an indication that it is entirely parasitic, whereas the genus now under consideration has the power of living freely, though doubtless parasitic at times.

Taking the larval form into consideration, we may perhaps be

* Herklots, Archives Néerlandaises, V., 1870.

† Weber, 'Separat-Abdruck aus zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien,' Band ii. Leiden, 1892.

justified in regarding *Ourozeuktes* as a descendant of some form similar to *Anilocra*, which has by semi-parasitism become modified, though one can hardly say distinctly degenerate.

EXPLANATION OF THE PLATES.

Plate XIII.

Fig. 1. *Ourozeuktes Owenii*, M.-Edw. Dorsal aspect.
2. „ „ Ventral aspect.
3. „ „ Lateral aspect.
4. „ „ From the front.
5. „ „ Larva. Dorsal aspect.
6. „ „ „ Lateral aspect.
7. „ „ „ Ventral aspect.

Plate XIV.

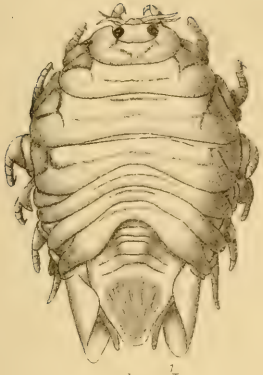
Ourozeuktes Owenii, Milne-Edwards.

[In regard to the details shown on this Plate, it is important to state that the observations were made on a single specimen without removing any of the parts—hence the difficulty of giving an absolutely true representation; but the drawings are the result of repeated examination, and there is no reason to doubt their substantial accuracy.]

Fig. 1. The head and mouth-appendages, seen from below; the latter partly covered by the first pair of oostegites.
Fig. 2. The same, with the first oostegites reflected, showing the maxillipedes.
Fig. 3. The same, with the maxillipedes supposed removed and the second maxillæ reflected back. The styliform first maxillæ are then seen directed forward to the labium, flanked by the mandibles and their palpi.
Figs. 5, 6, 7, 8. The mandibles, first and second maxillæ, and maxillipedes of the left side.
Fig. 9. The abdominal area, seen from the ventral side, with the fifth oostegites reflected and the right first abdominal appendage moved outward.
Fig. 10. Second abdominal (respiratory) appendage, seen from the dorsal and ventral aspects.
Fig. 11. Semidiagrammatic side view of the animal, to show the relations of the oostegites to each other and to the limb-sockets.

Reference letters.

M. Mouth.
Lbr. Labrum.
Lb. Bilobed labium.
Md. Mandibles.
Mx_1. First maxillæ.
Mx_2. Second maxillæ.
Mxp. Maxillipedes.
O_1 to O_5. The five pairs of oostegites forming the brood-chamber.
A_1. First abdominal appendage.
A_6. Last abdominal appendage.
A_2 to A_5. Abdominal respiratory appendages.
T_1 to T_7. Sockets of the thoracic appendages.



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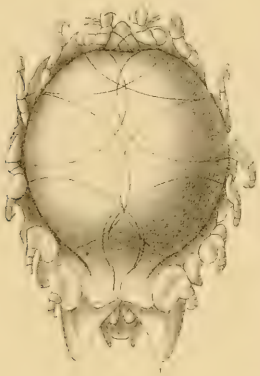

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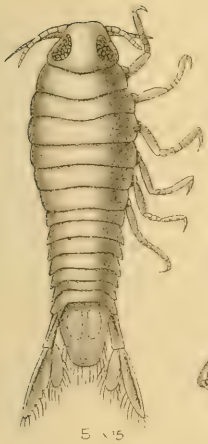

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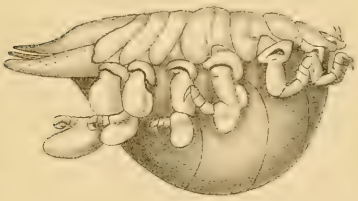

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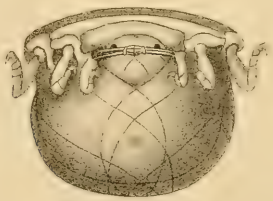

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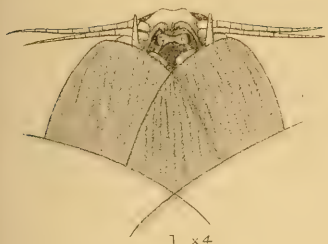
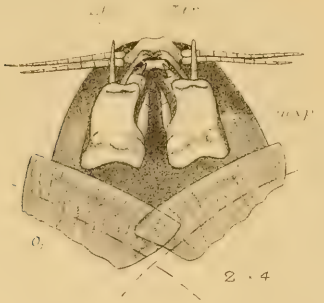
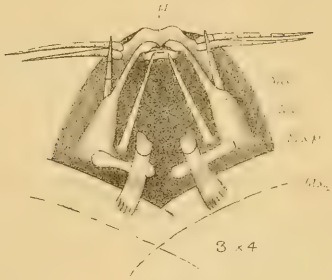
M.P.Parker lith. West,Newman imp.

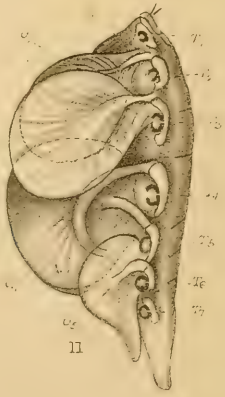
OUROZEUKTES OWENII. *Milne Edwards.*

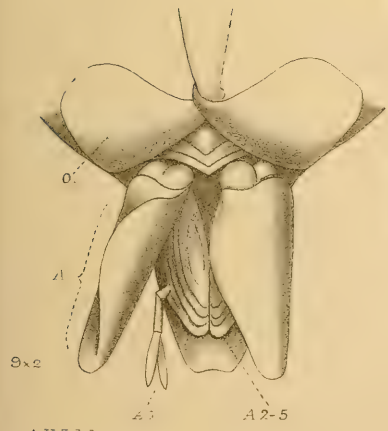
External form of adult & larva.











A.V.J. del.
M.P. Parker lith.

West, Newman imp.

OUROZEUKTES OWENII. *Milne Edwards.*
Appendages &c